Remington Arms Company, Inc.

Remington

DUPONT

RESEARCH AND DEVELOPMENT DEPARTMENT

AB-61-15

DEVELOPMENT AND FABRICATION OF PERCUSSION PRIMER FOR BAG LOADED WEAPONS

By
R. A. Sahlin and R. L. Bescher

November 9, 1961

SUMMARY REPORT

DEVELOPMENT AND FABRICATION OF PERCUSSION PRIMER FOR BAG LOADED WEAPONS (Unclassified Title)

Contract No. DA-19-020-ORD-5200
Project No. TW-103

REMINGTON ARMS COMPANY, INC.
Bridgeport, Connecticut

For
Feltman Research and Engineering Laboratories
Picatinny Arsenal, Dover, New Jersey

Copy No. 12

Contract No. DA-19-020-5200
Project No. TW-103

Development and Fabrication of Percussion Primer for Bag Loaded Weapons

PART I

Object

Design, development and fabrication of a percussion primer for bag loaded weapons.

Summary

The objectives of this contract were fulfilled.

A basic Picatinny design for the MX-82 primer, with design changes which proved to be necessary to meet functional requirements has been developed and on a basis of Remington and Government test results, the specified primer requirements have been met. Picatinny Arsenal has been furnished with 3,300 XM-82 primers. In addition, sample quantities of 300 each of two alternative designs were prepared and either furnished the Arsenal or in conjunction with the Project Officer expended in tests at this Plant.

A Remington first alternate design featuring drawn parts in place of screw machine parts which can be manufactured at substantially lower cost has been developed to a point where satisfactory performance is indicated by static tests in the firing lock. A small sample has been submitted for field testing and a separate contract is being negotiated to extend the work on this item.

A Remington second alternate which provides vast simplification and greater reduction in cost utilized an external gas sealing percussion element and a single drawn case with a folded closure. This primer showed metal parts failure on the first shot in a 175 mm weapon indicating the need for stronger construction to withstand the long pressure duration in an artillery weapon.

PART II

Introduction

The original scope of work called for design, development and fabrication of a percussion primer for bag loaded weapons with specific characteristics based on instructions, sketches and/or drawings furnished by the Project Officer. Design changes to attain the desired ease of manufacture and percussion sensitivity goals were to be approved by the Project Officer. One sample lot of the basic Picatinny design was to be fabricated. One sample of 300 was to have metal containers and one of 300 was to have plastic containers. Following approval of a single design, 3000 primers would be manufactured.

The scope of work was altered at the onset substituting the Remington first alternate design for the plastic container sample. In addition, a Remington second alternate design was developed on a supplement to the original contract. The alternate designs offered substantially greater reductions in manufacturing cost than the proposed plastic container through the application of small arms manufacturing methods.

Work on the Remington first alternate which is a drawn case design retaining the Picatinny head and plunger features progressed to a point where the firing of small samples in the firing lock indicated satisfactory performance and a small sample was submitted for an artillery field test which is still pending.* Due to limited development time and fabrication difficulties, this design was not considered for the 3000 primers required by this contract. However, this design is still under consideration and at Picatinny's request, a contract proposal has been submitted to extend development work and manufacture 500 primers.

The Remington second alternate which provides vast simplification and greater reduction in cost utilized an external percussion element and Remington developed wrap-around gas sealing primers in a center fire cartridge case with a folded closure. Preliminary tests in the firing lock indicated satisfactory performance; however, when tested in a 175 mm weapon the first round showed metal parts failure with minor damage to the firing lock on the weapon. It was apparent that the pressure duration in an artillery weapon is much too long for this type of primer construction and work on the second alternate was discontinued.

The basic Picatinny design with a metal container was developed in accordance with the drawings furnished by the Project Officer except for design modifications proved necessary to meet primer requirements. Picatinny Arsenal has been furnished with

---

* Since fired with good results

3,300 XM-82 primers. On the basis of Remington and Government test results, the specified functioning characteristics of the XM-82 percussion primer for bag loaded weapons have been met. Changes in the basic design involved modifying the plunger profile at the primer contact end and seating the primer in the ignition cup with a specific load to meet primer sensitivity requirements. In addition, the small arms technique of mouth annealing was used on the primer body to improve obturation on firing for better gas sealing and the elimination of body splits.

Results

A Remington first alternate design has been completed, based upon the fundamental construction principles of the Picatinny design. Modifications have been made to permit low cost component manufacture and assembly by methods similar to those employed in small arms ammunition making. A tentative manufacturing process has been developed to produce the respective components and to assemble the complete primer.

This process has been simulated on an experimental basis and a quantity of completed primers has been made. Ten of these samples have been submitted to Picatinny for evaluation. The remaining have been successfully fired by Remington in the static firing lock.

The Remington second alternate showed normal performance in static firing tests in the firing lock with respect to flash, report and gas sealing. However, a one-shot test in a 175 mm weapon showed metal parts failure in both head and mouth sections

with minor damage to the firing lock on the weapon. At the Project Officer's request, work on this design was discontinued.

The basic Picatinny design for the XM-82 primer, with previously described modifications, has been made in compliance with all drawings and specifications. Satisfactory methods were developed for the fabrication of components and assembly. Based on Remington and Government test results, the specified primer requirements have been met. Picatinny Arsenal has been furnished with 3,300 XM-82 primers.

Discussion of Results

The Remington first alternate design utilizes the Picatinny plunger, CXP97493, and incorporates all head dimensions of the outer case or body, as specified on drawing CXP97554. It is felt that the gas sealing performance of the first alternate should exactly duplicate that of the basic Picatinny design.

The Remington first alternate similarly utilizes a staked closure, the segmenting of which exactly duplicates that of the Picatinny closure AXP95523. Upon ignition it is felt that the rupture action of the closure and the consequent functioning of the primer should exactly duplicate that of the basic Picatinny design.

The inner case of the Remington first alternate serves as both a container tube and an ignition cup. In essence this inner case is a drawn, rimless, center fire shell with integral primer pocket, similar in all respects to those mass-produced today in the small arms industry. This inner case is press fit into the outer case and together with the staked closure is held in place

by a roll crimping of the mouth of the outer case.

With the elimination of the internal threading requirement, the outer case or body can be produced through the standard cartridge case-making processes of blanking, cupping, drawing, heading, head turning and tapering. The only required special operation is a finish reaming of the head to satisfy the dimensional tolerances of the basic Picatinny design.

The design of the Remington first alternate readily lends itself to mechanization during assembly. The standard dial type, multiple station tapering presses used in small arms case-making can be modified to perform the tapering, inner case seating, crimping and retapering operations.

All samples fired by Remington in the static firing lock produced a flash equal in intensity to the Mark 15 control primers. All staked closures opened uniformly in a manner exactly similar to the basic Picatinny design.

The Remington second alternate was proposed because it offered vast simplification in design and substantial cost reduction. The single drawn case with an external percussion, Remington developed, wrap around primer has been used successfully in small arms with adequate strength and excellent gas sealing at pressure levels as high as 50,000 psi. The single shot fired at Yuma in a 175 mm weapon which gave metal parts failure and damaged the firing lock could hardly be considered an adequate test for the design. However, it appears that the pressure duration in an artillery weapon is much too long for this type of primer construction.

In the development of the basic Picatinny design, satisfactory methods and procedures were developed for the fabrication and assembly of all component parts. Performance tests conducted and the results obtained are as follows:

1. Sensitivity tests in the specified sensitivity test fixture using the Bruceton method. Test Specifications - 16.34 ounce ball; no fires at 1½ inches, 100% fires at 9 inches. Sample size 25.

Lot	$\bar{X}$	σ
Pilot	3.33"	.76"
1	3.87"	.78"
2	3.60"	.80"
3 & 4	3.75"	.76"

2. Static firing tests in the firing lock were conducted at ambient temperature, -65°F and +165°F using the MK-15 primer as a control for the XM-82. An initial test was fired with 50 primers at each temperature, followed by two production quality check tests of 10 rounds at each temperature. All primers fired with uniform flash and closure rupture.

3. A severe cold test was conducted on XM-82 primers and MK-15 primers in which the primers were submerged in water plunger end up for 8 hours, then stored in the same position at -65°F for 16 hours. With the firing plungers immobilized with ice 50 XM-82 primers and 50 MK-15 primers were interfired in the firing lock with satisfactory performance.

4. A handling safety test was conducted in which a package of 20 XM-82 primers was dropped from a height of 40 feet onto a hard surface. In addition, 5 primers were provided with bomb type fins and dropped individually nose first from 40 feet. None of the primers fi and damage to the packaged primers was slight. Damage to the primers dropped individually was quite severe but confined to the nose. Sensitivity tests on the individually dropped primers in the sensitivity test fixture at the no fire level of 1½ inches with a 16.34 ounce weight gave no fires indicating no sensitivity increase resulting from the 40 foot drop.

5. A field test was conducted at Yuma, Arizona in a 175 mm weapon. The XM-82 primer gave satisfactory ballistic performance with poor obturation, minor body splits and mouth erosion as defects. Mouth annealing of the primer body was instituted to correct these defects.

6. Picatinny Arsenal conducted transportation vibration, jolt and jumble tests on 50 XM-82 primers. Subsequent tests in the firing lock and sensitivity test fixture gave satisfactory results.

7. An attempt was made to evaluate primer performance by photographing the flash produced in front of the spindle and/or measuring the sound level of the report produced on static firing in the firing lock. Neither of these tests showed performance differences.

EXPERIMENTAL DETAILS

The Remington first alternate design is illustrated in the sectioned assembly drawing DRL-2099.

Listed below are each of the major operations in the fabrication of the respective components and in the assembly of the completed primer.

Outer Case

Blank and Cup
Wash, Anneal and Lubricate
First Draw
Wash, Anneal and Lubricate
Second Draw
Cutoff
Head
Head Turn
Mouth Anneal
Taper
Head Ream
Head Stamp
Length Trim

Staked Closure

Blank and Cup
Flatten
Segment

Plunger

Machine from Rod

Inner Case

Blank and Cup
Wash, Anneal and Lubricate
First Draw
Wash, Anneal and Lubricate
Second Draw
Cutoff
Head
Head Taper
Anneal
Length Trim
Pierce and Prime

Assembly

Outer Case Alignment
Plunger Insertion
Prime Inner Case Insertion
Retapering
Black Powder Charging
Staked Closure Insertion
Outer Case Rollover
Roll Crimp Completion
Mouth Retapering

To fabricate the first sample primers utilization was made of in-process standard Remington components.

To satisfy the body or outer case requirements, a quantity of the standard small arms 300 Magnum cup as illustrated in SKRL-11-761-1 was withdrawn from stock. As withdrawn, these cups were annealed.

A first drawing operation was employed using a first draw

punch SKRL-11-861-1 and a die stack made up of a top die SKRL-11-761-2 , a .579" middle die and a .515" bottom die, illustrated in SKRL-11-761-3.

The pieces were then washed, annealed at 1220°F for 45 minutes and lubricated in a soapy water solution.

The second or final draw employed second draw punch SKRL-11-861-2 and a stack consisting of .500" top die, .486" middle die and a .481" bottom die, as illustrated in SKRL-11-761-3 . Both first and second draws were accomplished in a six-ton hydraulic press.

The final draw pieces were washed and cutoff to a length of 1.900" in preparation for heading. Heading was accomplished in a Bliss #4 header, using a punch, die and bunter as respectively shown in SKRL-11-761-7, 8 and 9. The headed pieces were given a light mouth anneal in preparation for tapering, with a resultant grain size of .020 mm and a transformation point approximately one inch from the mouth.

A very light facing cut was taken to clean up the face and establish a machined reference surface for the subsequent operations. The pieces were then head turned in a lathe, the rim being machined to the proper diameter, thickness and chamfer.

The tapering operation followed, being accomplished in a simple arbor press using tapering die SKRL-11-761-4.

The bridge or web which remained after heading was removed by drilling. A finish reamer illustrated in SKRL-11-861-8was used to clean up all inner surfaces and to achieve blueprint head dimen-

sional tolerances. Both drilling and reaming were accomplished in a drill press.

The final step performed on the outer case was a length trim of 1.750". The resultant outer case is illustrated in SKRL-11-861-5.

The standard commercial 30/30 Winchester untapered and unprimed shell was withdrawn from stock to serve as the inner case. These shells were cutoff to a length of 1-1/16". A 2½° taper was machined on the head of these shells to remove the rim and facilitate the insertion into the outer case at assembly.

A standard #72 primer, the same as used in the basic Picatinny design, was seated .005" below the face of the case. The primed inner case is shown in SKRL-11-861-4.

To satisfy the closure cup requirement, a standard 130 grain bullet jacket cup was withdrawn from production stock. The cups were cutoff to a length of .150". The V-groove rupture profile was applied to the bottom of the cup in a kick press using staking punch SKRL-11-761-5 and staking die SKRL-11-761-6. The resultant segmented closure is shown in SKRL-11-861-3.

Assembly was performed on a simple but very elaborately guarded arbor press.

The machined plunger was inserted manually in the body or outer case. The primed inner case was then pushed into position with a 3/8" pin. The tapering die SKRL-11-761-4 was used to restore the exact taper to the outer case. The original taper was disturbed when the larger diameter inner case was forced into place.

The assembly was then charged with 22 grains of black powder. A thin nitrocellulose, disc was placed on the ledge formed by the mouth of the inner case.

A thin film of epoxy resin was applied on the segmented closure which was manually inserted into the mouth of the primer. The closure was pushed in place resting on the same inner case ledge.

The roll crimping of the outer case was accomplished in three steps. The rollover punch, SKRL-11-861-6 was first used to turn the mouth inward. Next the arbor press ram end surface was used to flatten the rolled mouth. The roll-tightening punch, SKRL-11-861-7 was finally used to turn the mouth completely inward, tightening the roll crimp.

While the primer was now completely assembled, a final retapering operation had to be performed due to a slight mouth expansion which was realized during roll-crimping. Tapering die SKRL-11-761-4 was again applied. The roll-tightening punch, SKRL-11-861-7 was used to remove the completely finished primer from the tapering die.

In addition to the loaded primers previously mentioned, primer sensitivity samples and two hydraulic pressure samples were assembled.

The primer sensitivity samples were processed exactly as above with the exception that no black powder was introduced. After assembly a small hole was drilled in the closure cup to facilitate observation of primer ignition.

Drop testing of these samples indicated satisfactory sensitivity results.

The two hydraulic samples were assembled without plunger, inner case primer and powder. The closure cup that was used was not segmented. Hydraulic pressure was applied through the head to the closure cup and against the roll crimped mouth of the outer case. A pressure of 6000 psi was applied to both samples with no indication of any failure or loosening of the roll crimp.

Remington Second Alternative

The development of the second alternate single case design consisted of:

1. Modifying an existing 45/70 cartridge case to match the taper and outside diameter of the XM-82 body.
2. Machining the primer pocket and flash hole to accept the 30 caliber wrap around primer.
3. Shortening the case so as to better suit the volume requirements of the black powder charge.
4. Developing loading, crimping and sealing techniques to provide primer blast equal to the MK-15 standards.

Static firing test in the firing lock with visual observation showed performance equal to the MK-15 primer. A one-shot test in the 175 mm gun showed severe metal parts failure and work on this design was discontinued. See Drawing SKRL-8-860-1.

The Picatinny basic design for the XM-82 primer was developed with drawings furnished by Picatinny Arsenal with provisions for alterations where necessary to meet specified sensitivity characteristics and desired ease of manufacture. Drawings furnished:

Body	CXP97554
Plunger	CXP97493
Cup Ignition	BXP97495

Ignition Element Assembly	CXP97492
Tube Container	BXP97557
Washer	AXP95525
Disc	AXP95524
Closure	AXP95523
Cup Container	AXP95520
Container Assembly	BXP97556
Primer, Percussion, XM-82 Assembly	CSP97553
Sensitivity Testing Fixture	Sketch No. 1

The specific characteristics outlined for the XM-82 primer were as follows:

1. No primer shall function under the impact of a standard 1-29/32" steel ball weighing 16.34 ounces, dropped from a height of 1½" on the prescribed firing pin.

2. All primers shall function under the impact of a standard 1-29/32" steel ball weighing 16.34 ounces, dropped from a height of 9 inches on the prescribed firing pin.

3. The primer shall function reliably in temperature ranges from -65°F to +160°F using a firing lock. The characteristics of this firing lock will supply percussion energy for firing the primer which will be of the same magnitude as will be developed for use with the XM-82 primer and equal to or greater in magnitude than the all-fire energy described in Item 2 above.

4. The primer shall be capable of firing after being subjected to the following tests:

   a. Transportation Vibration Test MIL. Std.-303.

   b. Temperature and Humidity Test MIL. Std.-304.

   c. Jolt Test MIL. Std.-300.

   d. Jumble Test MIL. Std. 301.

These tests were conducted by Picatinny.

5. Commercially available or Government standard percussion elements shall be used.

Component Fabrication

Body, plunger, ignition cup and tube container components were made by outside vendors. Inspection of these pieces showed that all specifications were met.

To improve obturation for improved gas sealing and the elimination of splits on firing, a mouth annealing operation was performed on the primer body after machining. Mouth annealing was done on automatic equipment with a manifold of ten internal combustion porcelain lined burners and a Kemp carburetor which mixes air and natural gas in proper proportion. Bodies were annealed one-half inch on the mouth to the following specifications:

Hardness - Rockwell 15T $\frac{1}{4}$" from mouth 70-75
Rockell 15% 1" from mouth 79-81

Grain size $\frac{1}{2}$" from mouth .020-.025 mm

The stamping of primer identification on the primer body head including date and lot number was done with an air operated impact hammer. Specifications called for letters and figures .042" high and .010" deep. Initially the body was supported internally on a stem which was found to be inadequate due to reduction in diameter of the plunger hole from the force required to obtain a legible head stamp. The supporting stem was modified to include a pilot in the plunger hole and external support for the rim was added. With this set up it was found that a legible head stamp with letters and figures from .002" to .004" deep could be obtained without head distortion.

The plunger design was modified by changing the spherical

profile at the primer contact end to a flat of approximately 0.070" on the spherical profile. The 0.010" reduction in length effected by this change was compensated for at percussion element seating. It was found that the percussion element must be seated with a dead load of not greater than 200 pounds which assures full seating but does not shorten the primer assembly to give added sensitivity.

The container cup was fabricated at Remington using conventional blank, cup and flatten methods. The V-groove rupture profile was applied in a separate die with a hobbed insert. At first a kick press was used to stamp the rupture profile but difficulty was encountered controlling the force applied and staying within rupture pressure limits. Although the quality of these container cups was equivalent to samples furnished by Picatinny, it was found possible to improve the control of rupture profile stamping by using an air operated impact hammer. With this equipment, rupture pressure specifications were met with ease. Container cups were stamped in lots of 100 with a rupture test conducted on each lot before it was accepted as product. Rupture pressure determinations which were made hydraulically with the cup silver soldered in a container gave the following results. Specification - between 1000 and 2000 psi.

	Picatinny	Remington	Remington
Stamping Method		Kick Press	Air Hammer
Sample Size	10	10	50
Avg. Rupture Pressure psi	2370	1830	1500
Max.	2800	2200	1700
Min.	2000	1500	1300
E.V.	800	700	400

The container cup was secured in the container by silver brazing with brazing preforms. An overlap outside diameter ring .010" larger than the inside diameter of the container was made using 1/32" diameter wire with a spring winding technique. The ring is inserted just below the container cup position and flux is applied to both ring and container. This assembly is placed on a vented ceramic jig and the container cup put in position and held in place with a retainer pin. Heat is applied with gas/air burners until the solder flows upward forming a uniform ring around the edge of the container cup. Attempts to apply silver solder to the top or outside of this assembly gave negative results due to migration of the solder into the rupture section of the container cup. After cleaning to remove excess flux, the container assemblies from the preferred procedure were air tested with 20 pounds per square inch pressure for ten seconds for leaks. Defects were less than one percent.

A die set was designed and made for blanking chipboard washers and onion skin paper discs. Washers were glued to strips of onion skin paper before the paper disc was blanked.

Container assemblies were hand loaded using a volumetric scoop with 22 $\pm$ 1 grains of black powder grade A3. After loading the closure was pressed into position and sealed with nitrocellulose lacquer.

Assembly

With the quantity involved on this contract the assembly operation was limited to hand tools except for power driven screw

drivers which were used to pre-screw the ignition element and container assembly into place. Final tightening to the specified torque of 15 ± 2 inch-pounds was done on a separate fixture. The assembly procedure used is as follows:

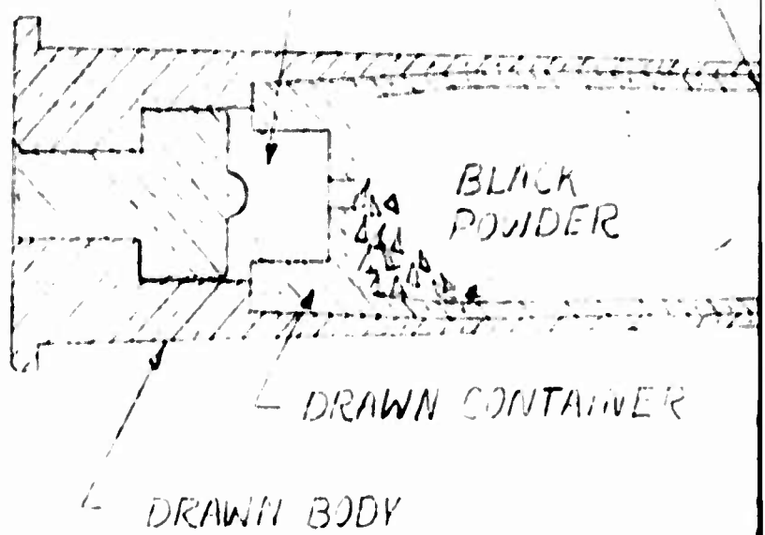
1. Drop plunger into body and shake into position.
2. Coat threaded surface of ignition element with nitrocellulose lacquer and screw into position with power screw driver.
3. Tighten ignition element with a torque of 15 ± 2 inch-pounds in torque fixture.
4. Coat threaded surface of loaded container assembly with nitrocellulose lacquer and screw into position with power screw driver.
5. Tighten container assembly with a torque of 15 ± 2 inch-pounds in torque fixture.
6. Seal joint between body and container charge assembly with nitrocellulose lacquer.

Final Gauging and Inspection

1. Hand roll to inspect all exterior surfaces for visual defects.
2. Shake each primer individually to check for free plunger movement.
3. Chamber gauge 100 percent in firing lock to assure free chambering in the field.

RAS/RLB:MR

D



1

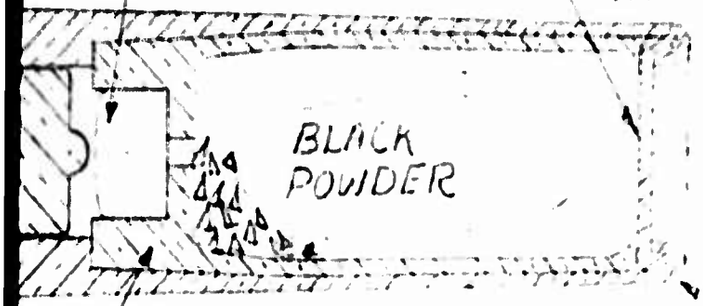
RECORD OF ALTERATIONS	ADDITIO

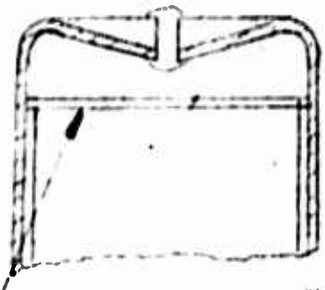
UNLESS OTHERWISE SPECIFIED ALL FRACTIONAL FINISH DIMENSIONS $\pm .01$ ALL DECIMAL DIMENSIONS $\pm .001$ DO NOT SCALE THIS

Form RD 885

PRIMER
LACQUER SEALED

STAKED CUP TO RUPTURE
AT 1000-2000 PSI





DRAWN CONTAINER

ROLL CRIMP SEALED
WITH EPOXY RESIN

ALTERNATE CLO
EPOXY RESIN SEAL
OPTIONAL CONSUM
DISC, LACQUER SEA

RAWN BODY

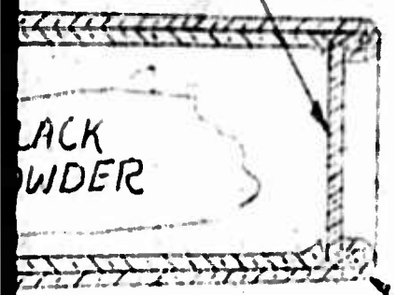
2

SPECIFICATION NO.		DRAWING NO. DRL 2099				REMINGTON BRIDGEP	
SUPERSEDES DWG.						SCALE	
CONST. DWG.		MAIN TITLE PRIMER, PERCUSSIO					
		DRAWN CASE DESIGN					
		SUB TITLE					
ADDITIONAL USES		DESIGN BY		TRACED BY		APPROVED	
ALL DECIMAL DIMENSIONS +.001 -.001 DO NOT SCALE THIS DRAWING WORK TO FIGURES		DRAWN BY EMY 4-13-61		CHECKED BY		APPROVED	

K-E

R
E SEALED

STAKED CUP, TO RUPTURE
AT 1000-2000 PSI.



LACK
WIDER

ONTAINER

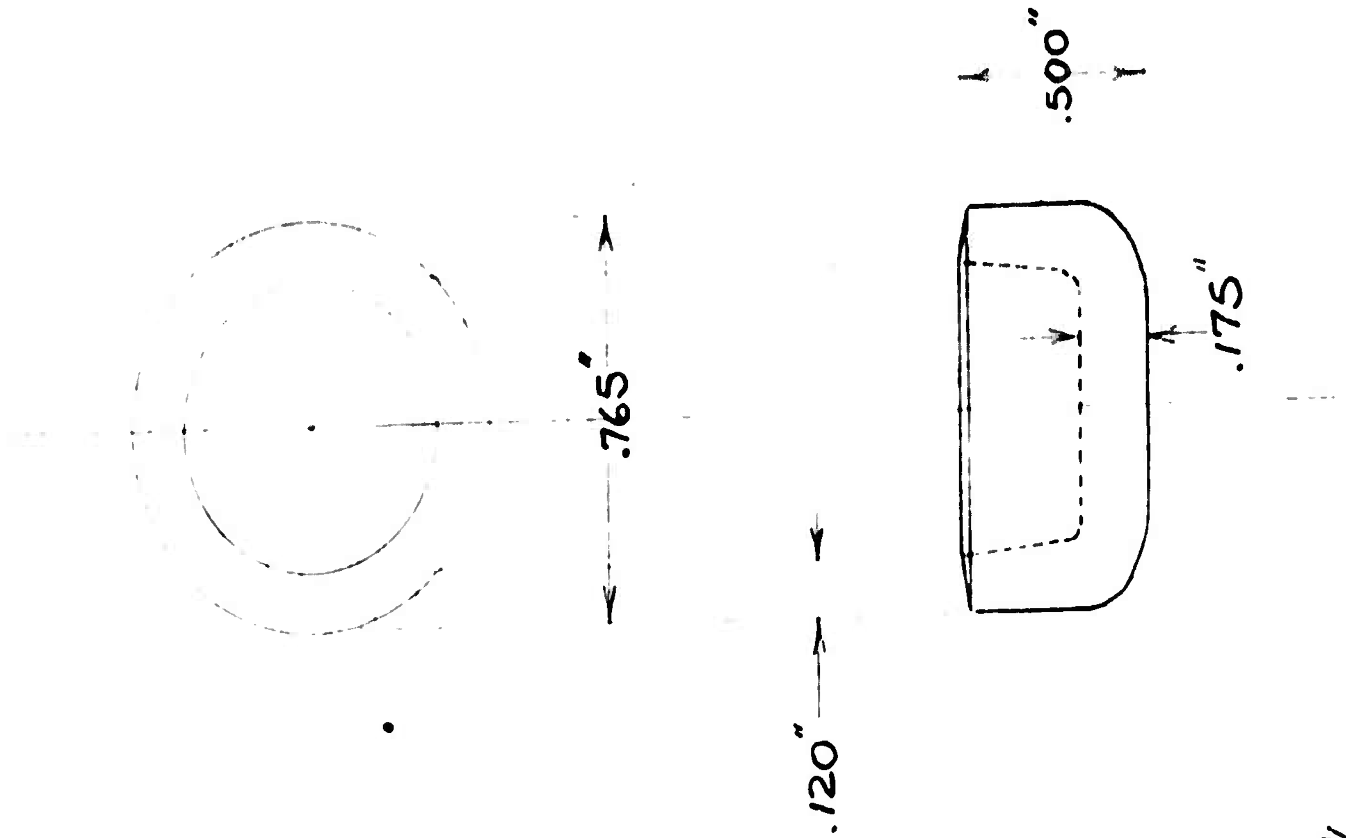
ROLL CRIMP SEALED
WITH EPOXY RESIN

ALTERNATE CLOSURE,
EPOXY RESIN SEALED
OPTIONAL CONSUMABLE
DISC, LACQUER SEALED

3

SPECIFICATION NO.		DRAWING NO. DRL 2099		REMINGTON ARMS CO. INC. BRIDGEPORT WORKS			
SUPERSEDES DWG.				SCALE		ORDER NO.	
CONST. DWG.		MAIN TITLE PRIMER, PERCUSSION DRAWN CASE DESIGN					
		SUB TITLE					
ADDITIONAL USES		DESIGN BY		TRACED BY		APPROVED	APPROVED
01 DO NOT SCALE THIS DRAWING WORK TO FIGURES 01		DRAWN BY EMY 4-13-61		CHECKED BY		APPROVED	APPROVED

K•E ALBANENE 196M TRACING PAPER 66747



NOV 9 1961

MATER: 70-30 BRASS

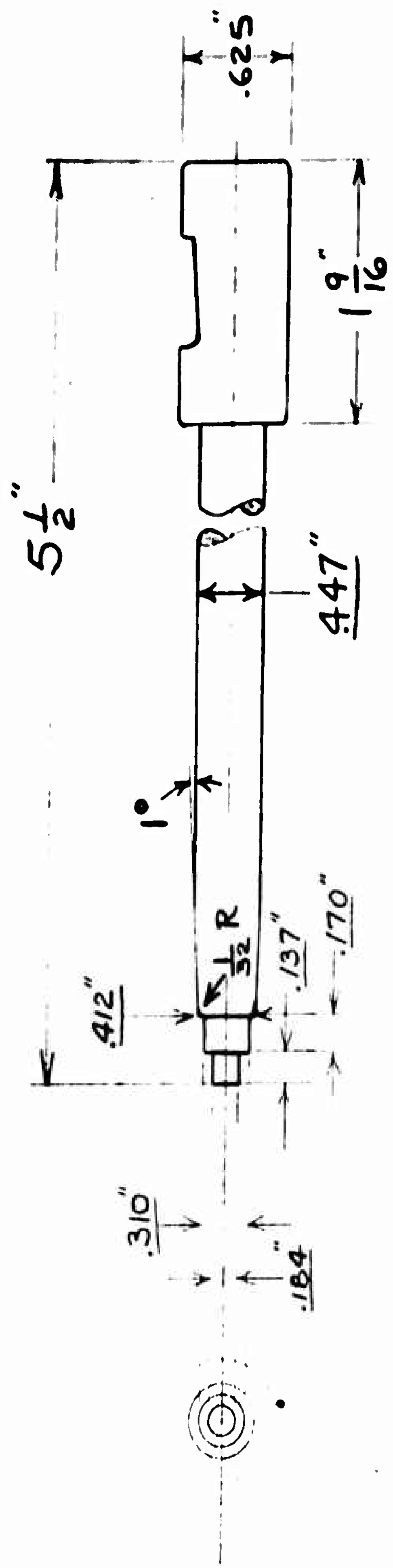
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

OUTER CASE CUP
XM82 - FIRST ALTER.

DRAWN RLB | APP'D | DATE 11/7/6

SKRL-11-761-1

R. D. 979 Rev



MATER: HARDENED
CAR.- TOOL STEEL

NOV 9 1961

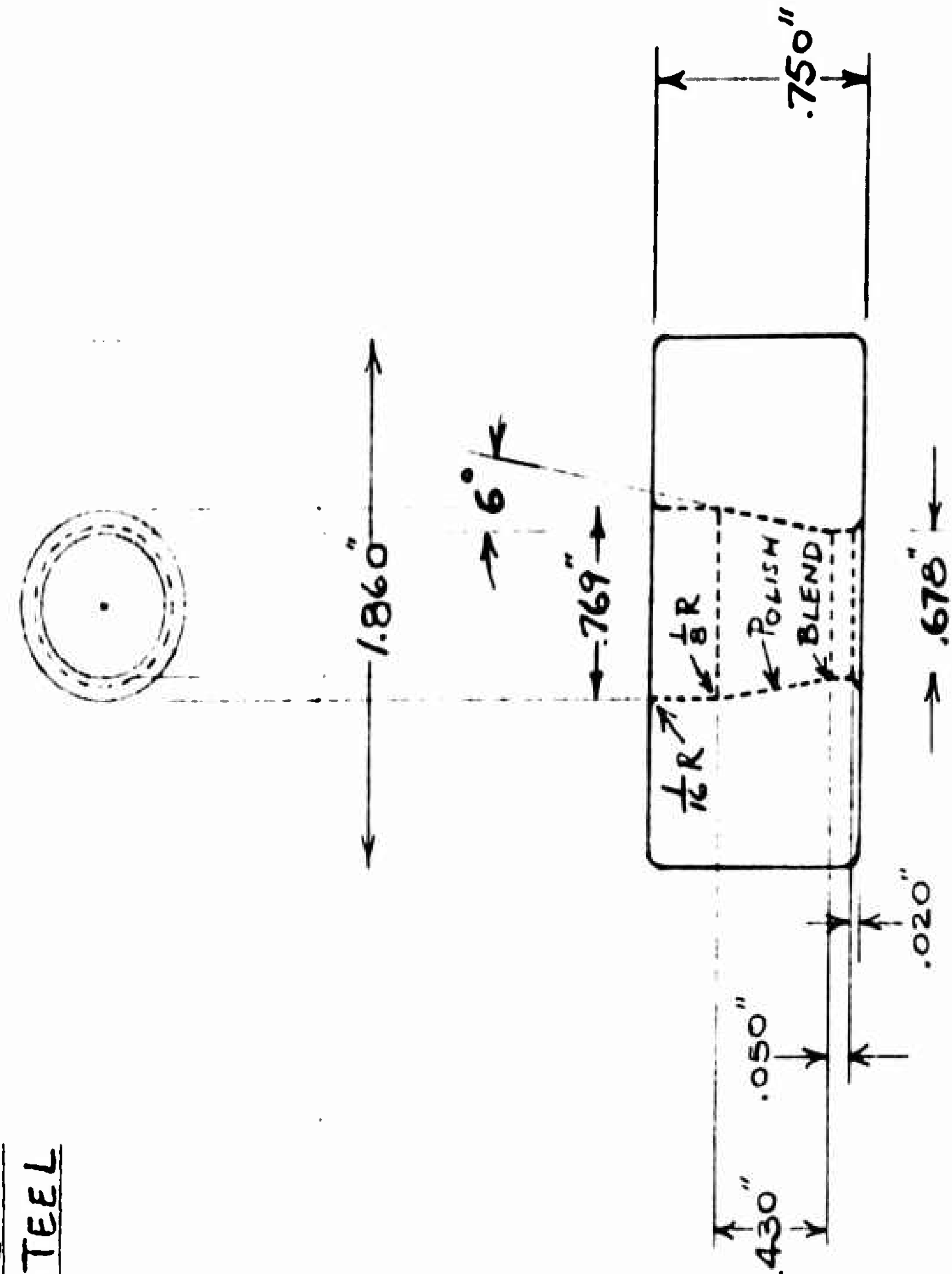
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

FIRST DRAW PUNCH
XM82 - FIRST ALTER.

DRAWN R.d.B.	APP'D	DATE 11/8/61

SKRL- 11-861-1

R. D. 979 Rev.



MATER: HARDENED CAR.-TOOL STEEL

NOV 9 1961

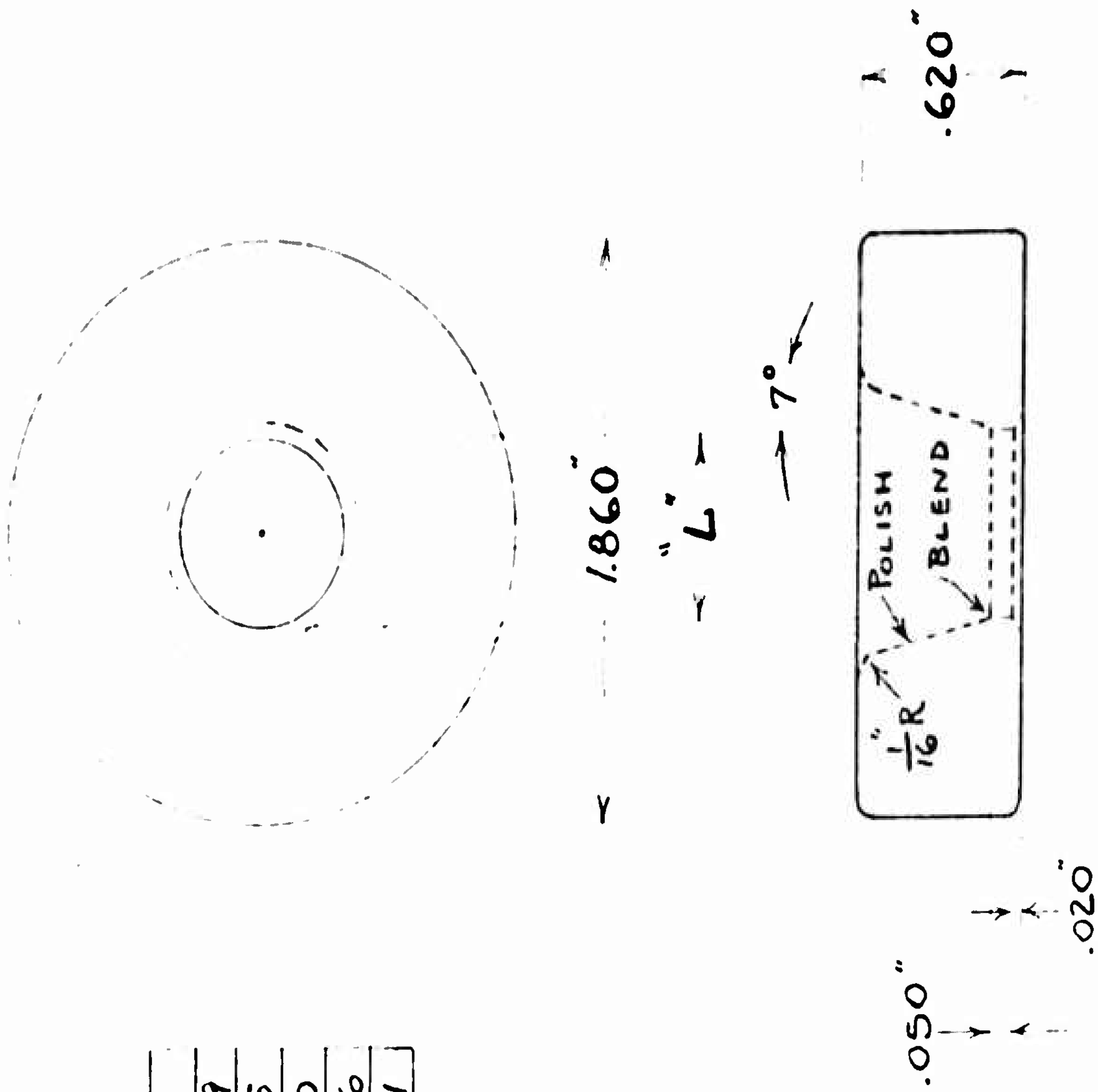
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

TOP DIE
XM82 - FIRST ALTER.

DRAWN R L B | APP'D | DATE 11/7/61

SKRL- 11-761-2

R. D. 979 Rev.



NOV 9 1961

MATER: HARDENED
CAR.-TOOL STEEL

OPERATION	"L"
1st DRAW	.579
"	.515
2nd DRAW	.500
"	.486
"	.481

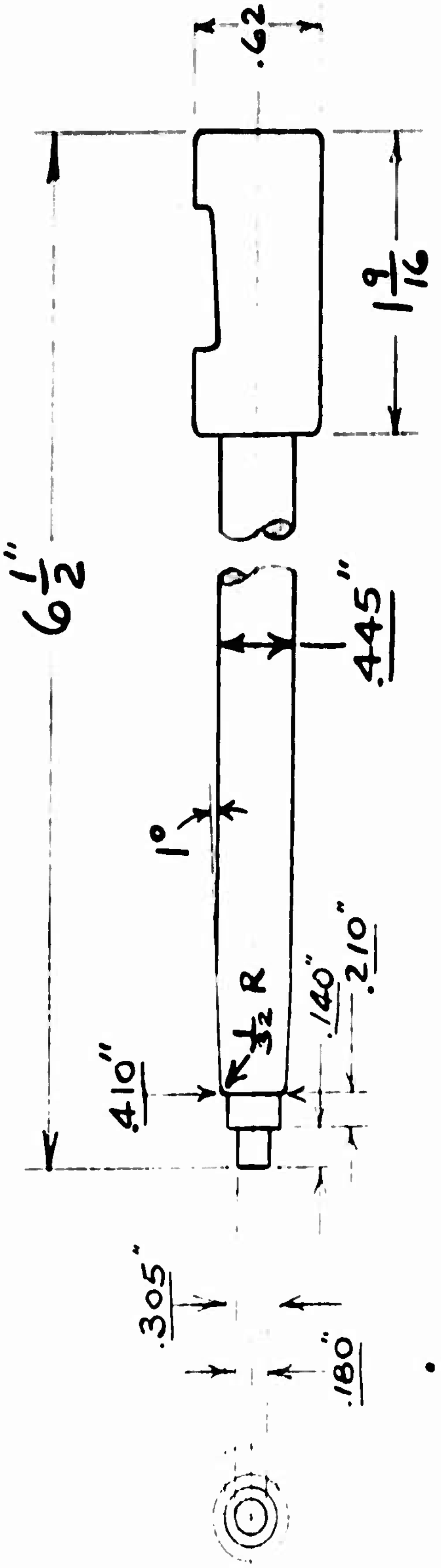
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

DRAW DIES
XM82 - FIRST ALTER.

DRAWN R.L.B. | APP'D | DATE 11/7/61

SKRL- 11-761-3

R. D. 979 Rev.



MATER: HARDENED
CAR.- TOOL STEEL

NOV 9 1961

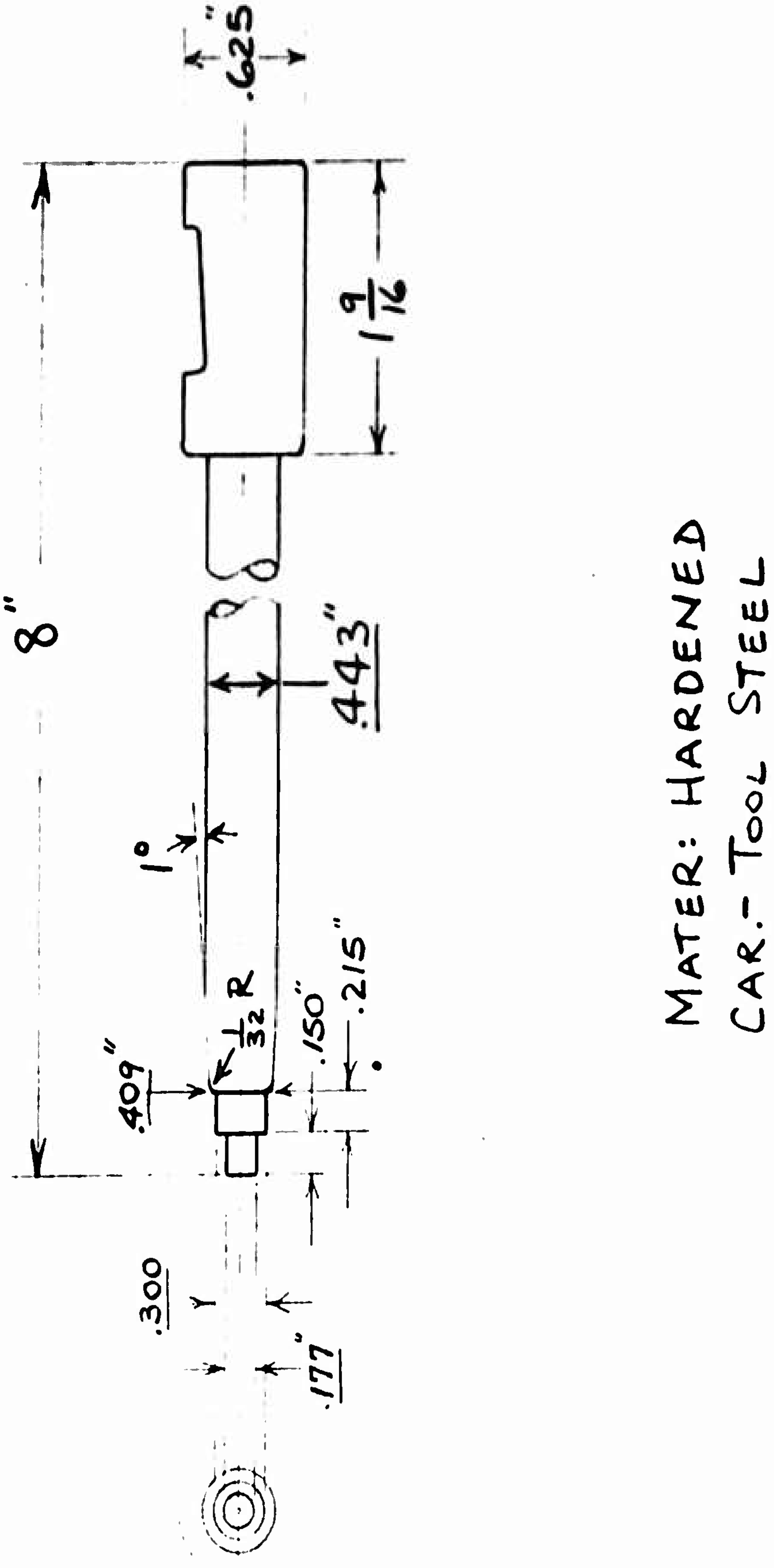
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

SECOND DRAW PUNCH
XM82 - FIRST ALTER.

DRAWN RLB | APP'D | DATE 11/8/61

SKRL- 11-861-2

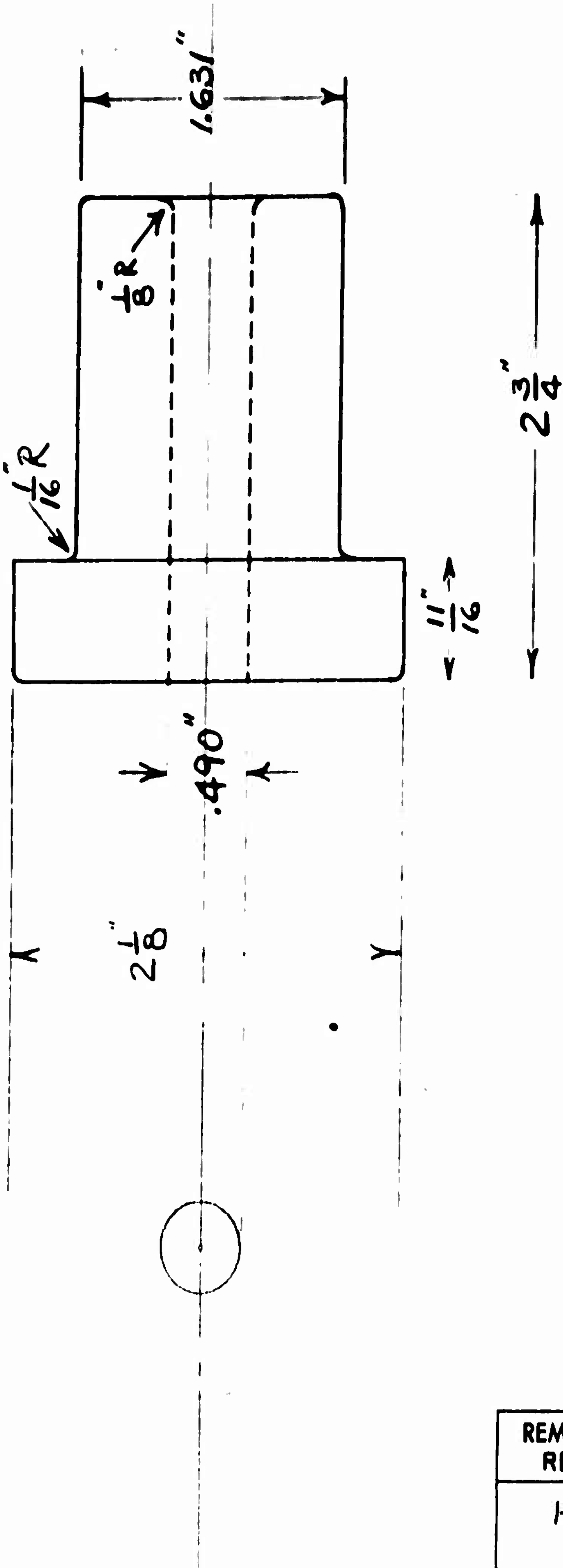
R. D. 979 Rev.



NOV 9 1961

REMINGTON ARMS CO., INC., — BPT., CONN. RESEARCH & DEVELOPMENT DEPT.
HEADING PUNCH XM82 - FIRST ALTER.
DRAWN [illegible] APP'D DATE 11/7[illegible]
SKRL- 11-761-7

R. D. 979 Rev.



MATER: HARDENED
CAR.-VAN. TOOL STEEL

NOV 9 1961

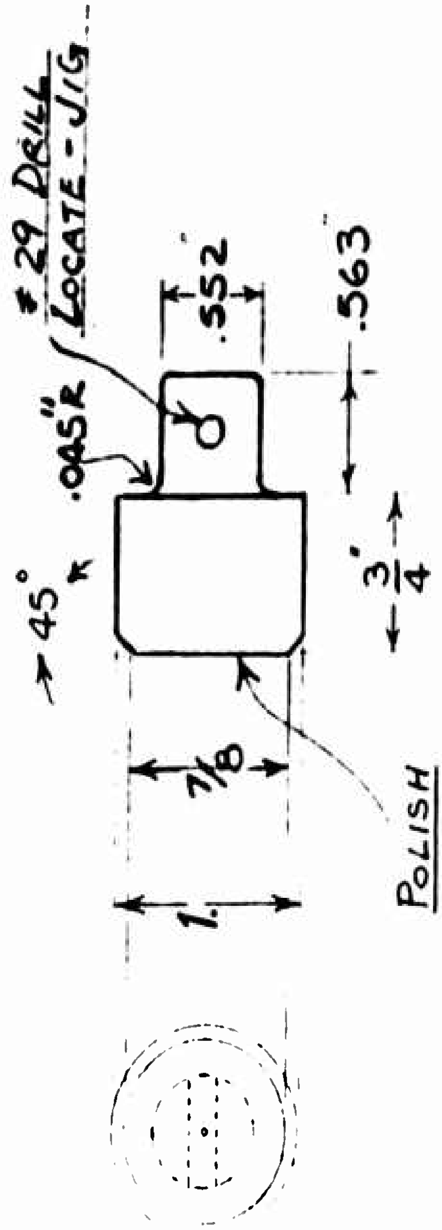
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

HEADING DIE
XM82 - FIRST ALTER.

DRAWN R.A.B. | APP'D | DATE 11/7/61

SKRL- 11-761-8

R. D. 979 Rev.



MATER: HARDENED
CAR. - TOOL STEEL

NOV 9 1961

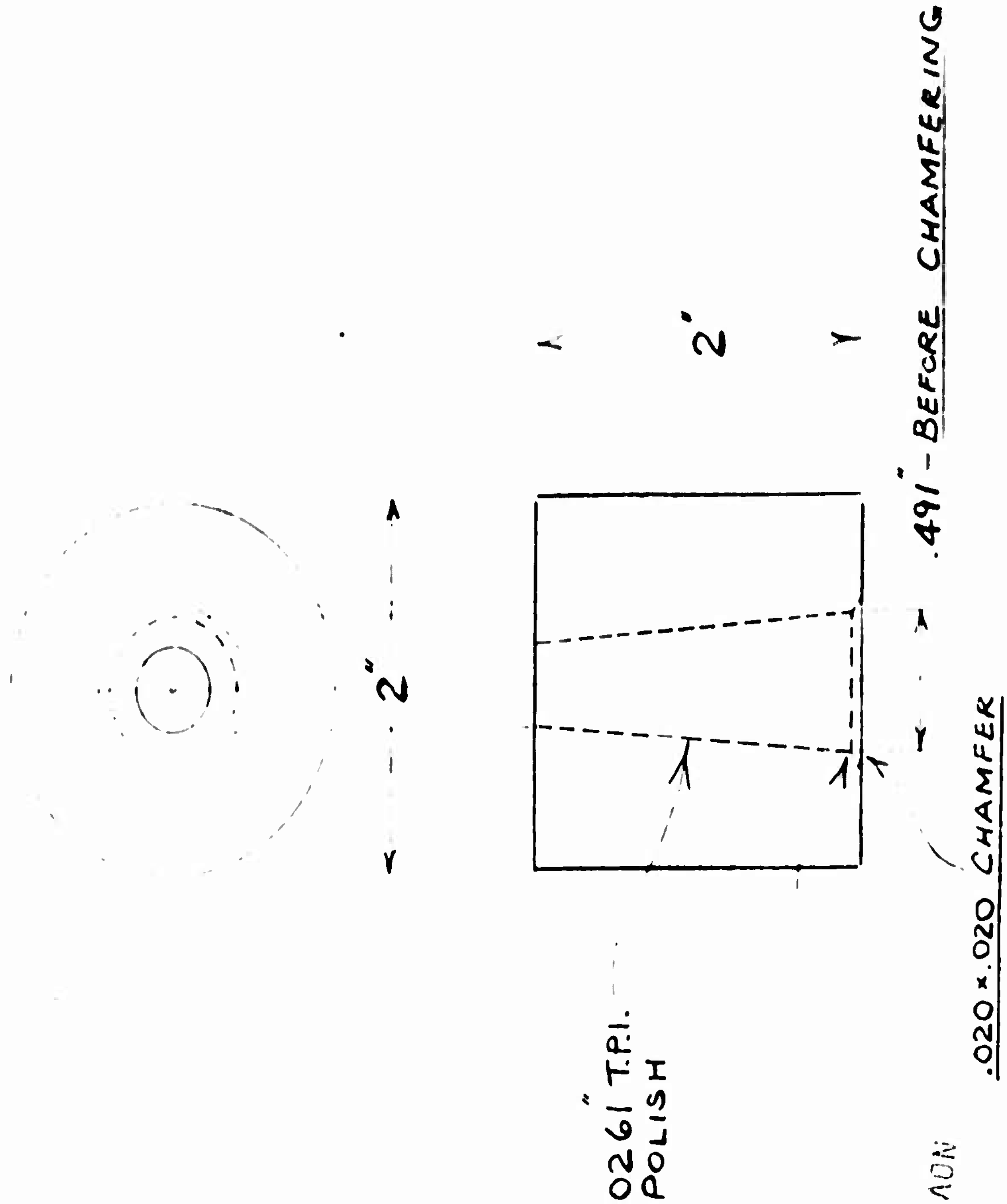
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

HEADING BUNTER
XM82 - FIRST ALTER.

DRAWN	APP'D	DATE 11/7/61

SKRL- 11-761-9

R. D. 979 Rev.



NOV 9 1961

MATER: HARDENED
CAR.- TOOL STEEL

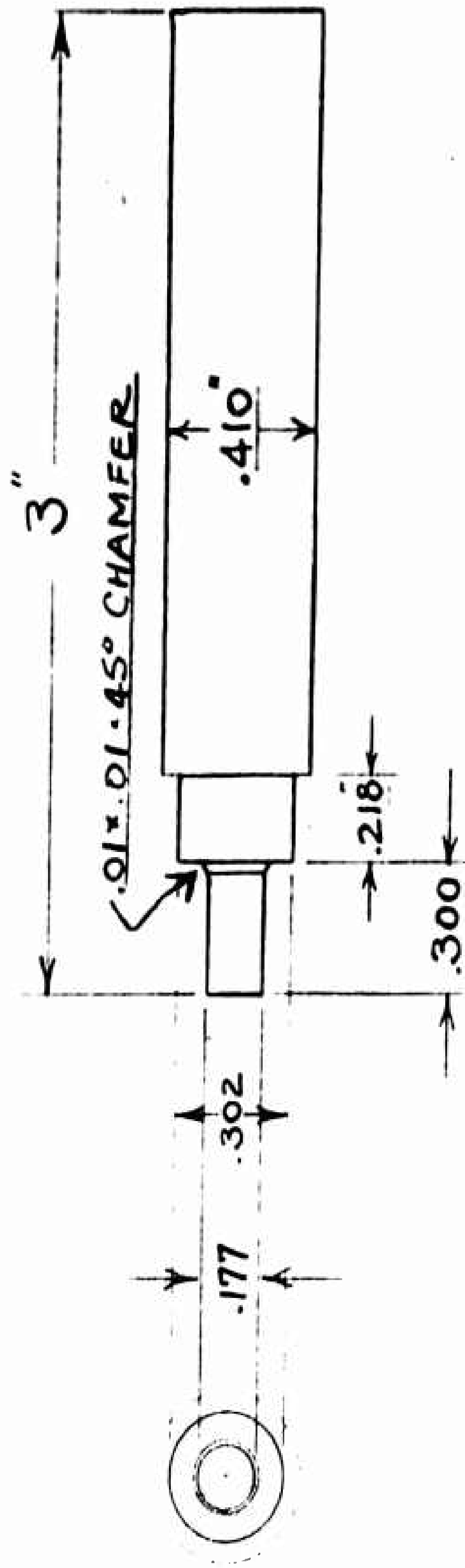
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

TAPERING DIE
XM82 - FIRST ALTER.

DRAWN RLB | APP'D | DATE 11/7/61

SKRL- 11-761-4

R. D. 979 Rev.



MATER: HARDENED
CAR.- TOOL STEEL

NOV 8 1961

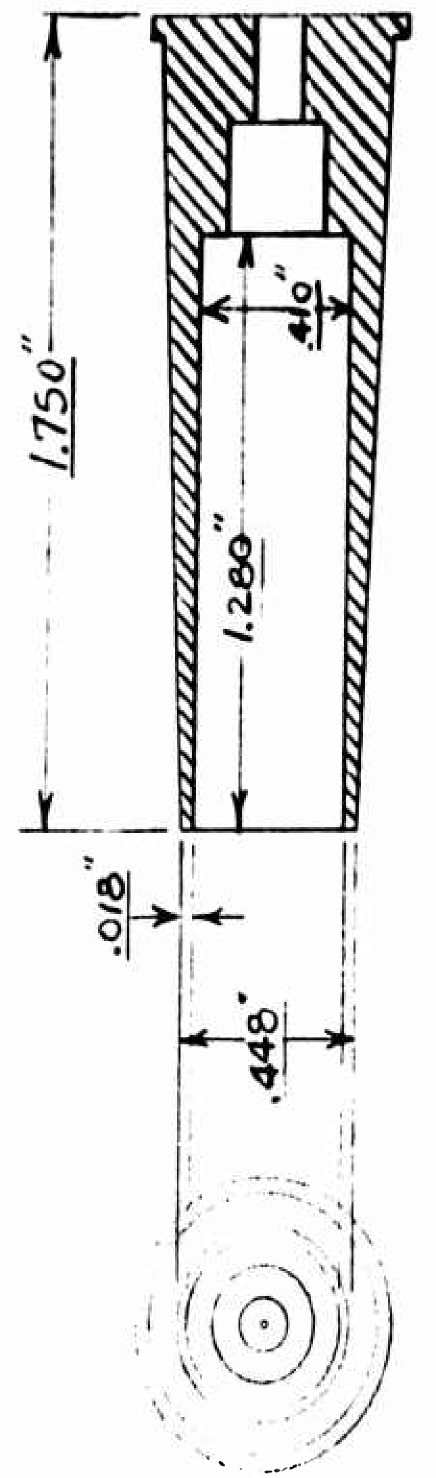
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

FINISH REAMER
XM82 - FIRST ALTER.

DRAWN R.A.B.	APP'D	DATE 11/8/61

SKRL- 11-861-8

R. D. 979 Rev.



MATER: 70-30 BRASS

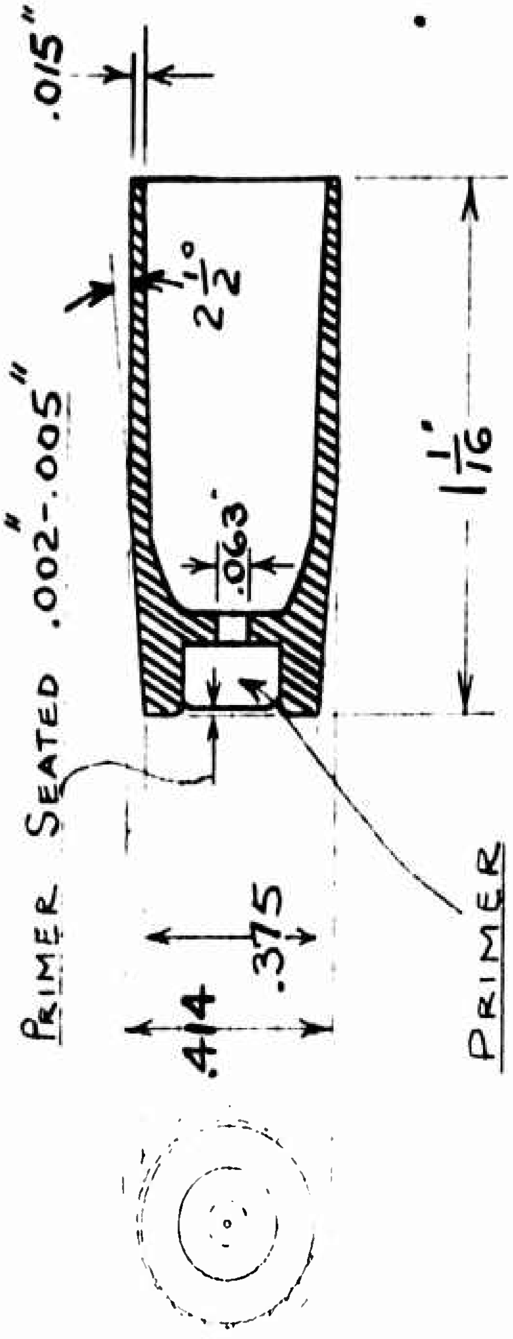
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

OUTER CASE
XM82 - FIRST ALTER.

DRAWN R. A. B. | APP'D | DATE 11/8/61

SKRL- 11-861-5

R. D. 979 Rev.



MATER: (INNER CASE)
70-30 BRASS

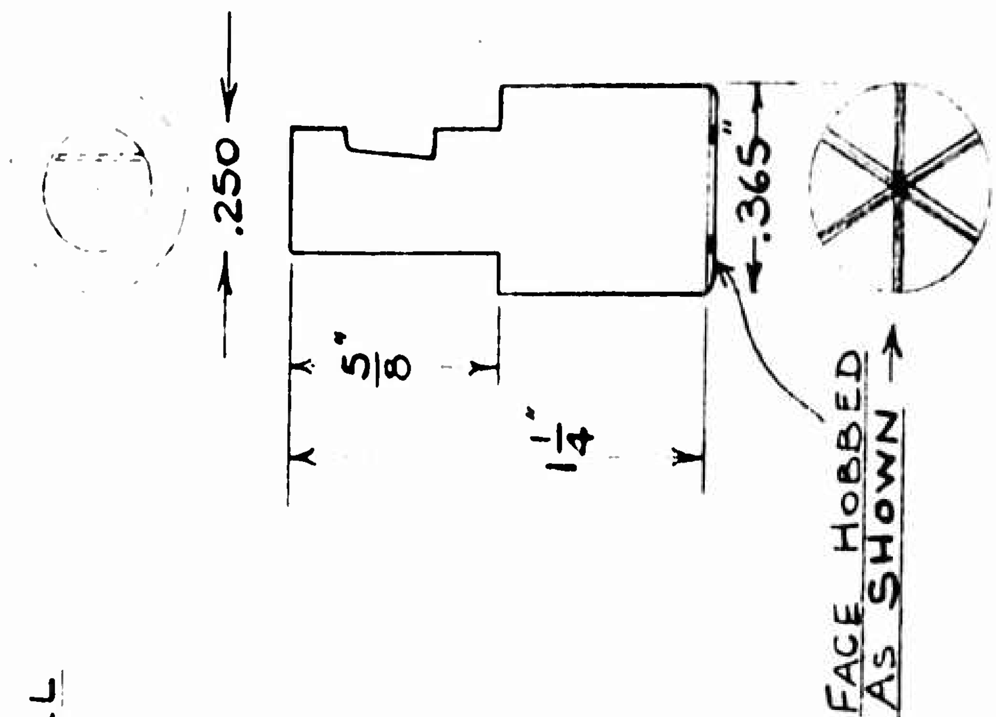
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

PRIMED INNER CASE
XM82 - FIRST ALTER.

DRAWN RdB | APP'D | DATE 11/8/61

SKRL-11-861-4

R. D. 979 Rev.



MATER: HARDENED
CAR.-VAN. TOOL STEEL

9 1961

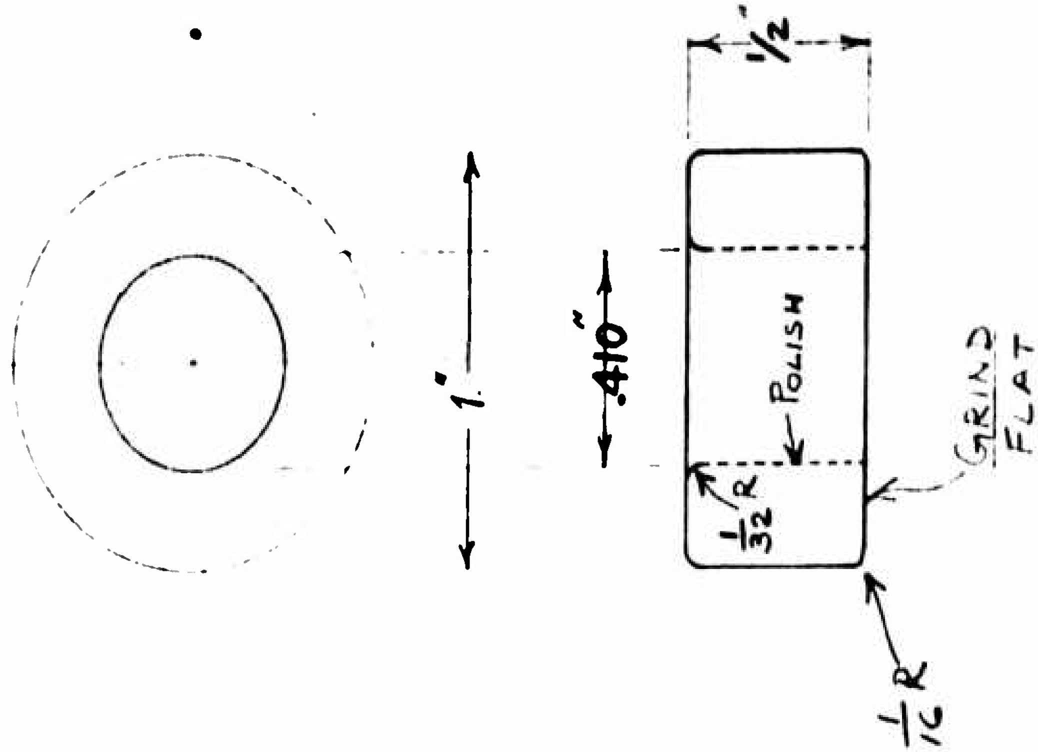
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

STAKING PUNCH
XM82 - FIRST ALTER.

DRAWN | APP'D | DATE 11/7/61

SKRL- 11-761-5

R. D. 979 Rev.



MATER: HARDENED
CAR.- TOOL STEEL

9 1961 ACN

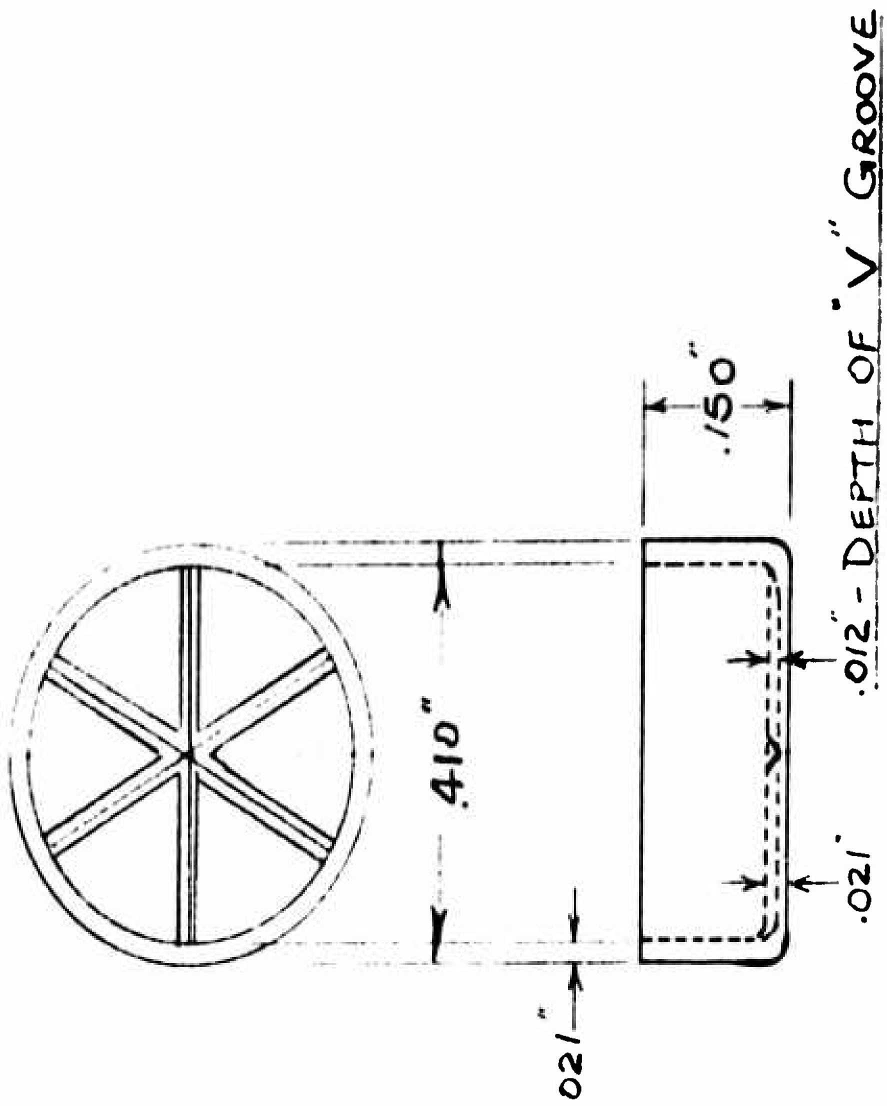
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

STAKING DIE
XM82- FIRST ALTER.

DRAWN	APP'D	DATE 11/7/61

SKRL-11-761-6

R. D. 979 Rev.



MATER: COPPER
ANNEALED

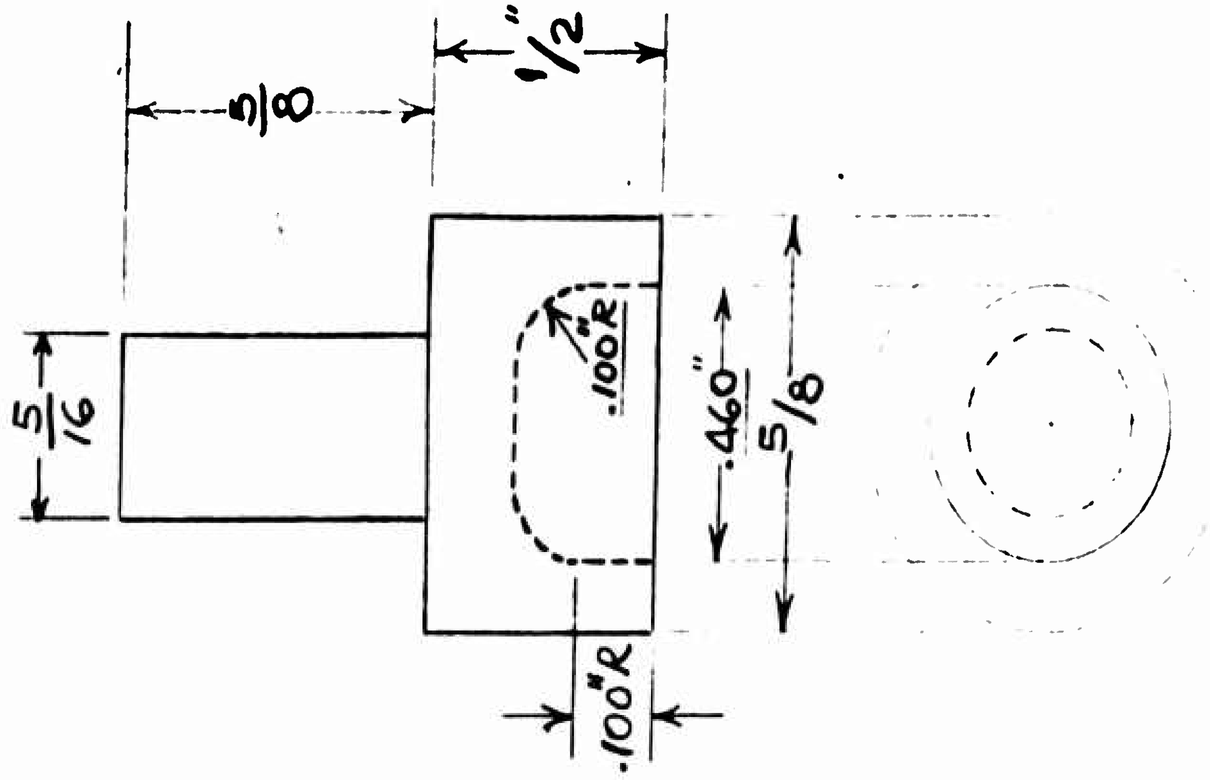
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

SEGMENTED CLOSURE
XM82 - FIRST ALTER.

DRAWN RLB | APP'D | DATE 11/8/61

SKRL-11-861-3

R. D. 979 Rev.



MATER: HARDENED
CAR.- TOOL STEEL

NOV 9 1961

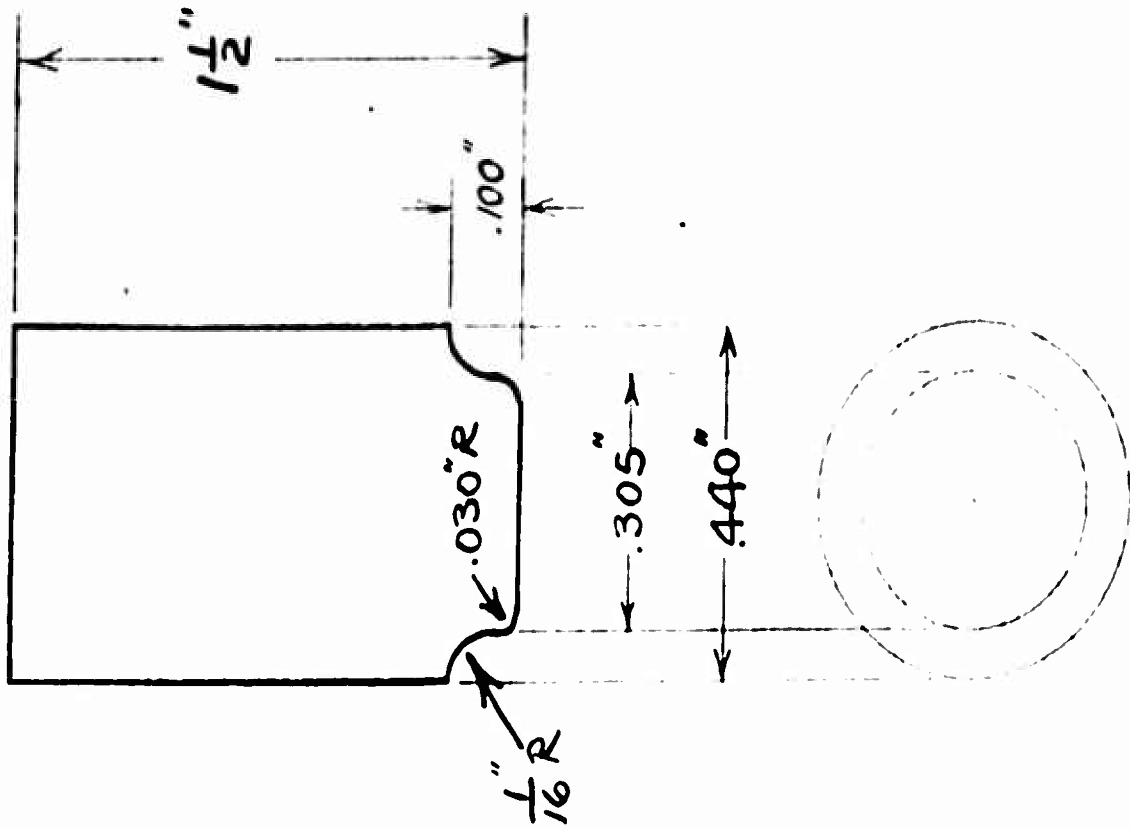
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

ROLLOVER PUNCH
XM82 - FIRST ALTER.

DRAWN R.L.B. | APP'D | DATE 11/8/61

SKRL- 11-861-6

R. D. 979 Rev.



MATER: HARDENED
CAR.- TOOL STEEL

NOV 9 1961

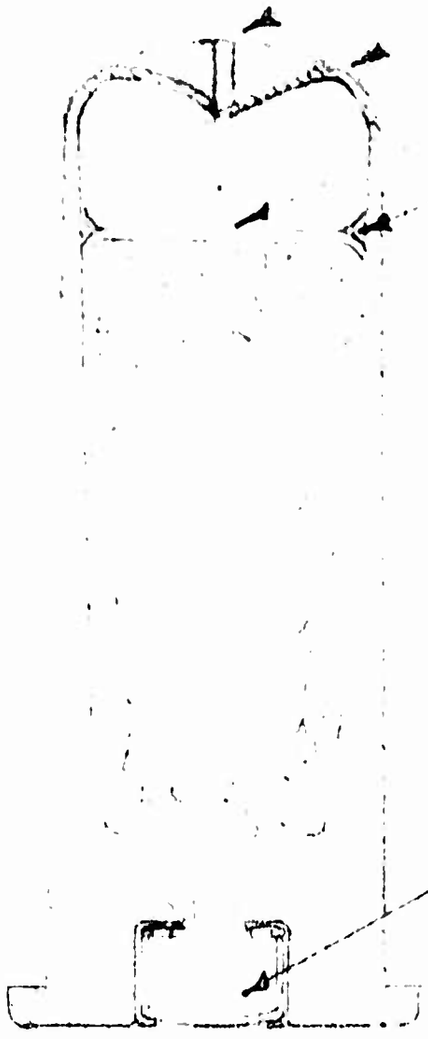
REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

ROLL-TIGHTENING PUNCH
XM 82 - FIRST ALTER.

DRAWN RdB | APP'D | DATE 11/8/61

SKRL- 11-861-7

R. D. 979 Rev.



REMINGTON ARMS CO., INC., — BPT., CONN.
RESEARCH & DEVELOPMENT DEPT.

PRIMER, PERCUSSION,
REMINGTON
SECOND ALTERNATE

DRAWN	APP'D	DATE
E.M.Y		8-8-60

SKRL- 8 - 860 - 1

R. D. 979 Rev.

DISTRIBUTION

Commanding Officer Picatinny Arsenal Dover, New Jersey Attn. Purchasing Office ORDBB-PB1	5
Office, Chief of Ordnance Department of the Army Washington 25, D. C. Attn. ORDTW	1
Armed Services Technical Information Agency Arlington Hall Station Arlington, Virginia	10
Commanding General Aberdeen Proving Ground Aberdeen, Maryland Attn. QRDBG-BRL	1
Commanding Officer Diamond Ordnance Fuze Laboratories Washington 25, D. C. Attn. Technical Reference Section	1
Contracting Officer Boston Ordnance District Army Base, Boston, Mass. Attn. ORDEB-LD	1
Office of Technical Services Department of Commerce Washington 25, D. C. Attn. Acquisition Section	2